I claim: 4467-103

1. A method for making or monitoring an electronic device, comprising the steps of:
measuring an analyte selected from the group consisting of a material in the electronic device, a constituent of the material, a byproduct of the material, a reaction product of a constituent of the material, a contaminant , and a tag;
detecting more than one physical, chemical, or physico-chemical property of the analyte;
combining the detected properties to produce a signal output;
processing the signal output with multivariate analysis to convert the signal output into information representative of a quality of the material, a constituent of the material, or a variable in processing the material.

2. A method according to claim 1, wherein the multivariate analysis comprises processing the signal output with a pattern recognition algorithm sufficient to classify, compare, or discriminate the material based on at least one member selected from the group consisting of quantity, quality, performance, physical, chemical, physico-chemical properties, environmental effects, or timing effects.

3. A method according to claim 2, wherein the multivariate analysis uses unsupervised statistical pattern recognition.

4. A method according to claim 2, wherein the multivariate analysis uses supervised statistical pattern recognition.

5. A method according to claim 1, wherein the analysis is at least one member selected from the group consisting of classical least squares (CLS), inverse least squares (ILS), partial least squares (PLS), principal components analysis (PCA), principle components regression (PCR), nonlinear principle components regression (NLPCR), nonlinear partial least squares (NLPLS), deterministic finite-state automata (DFA), Fast Look-up Algorithm for String Homology (FLASH), pattern recognition, and neural networks.

6. A method according to claim 1 wherein the quality analysis comprises sensory evaluation of the sample materials by human paneling.

7. A method according to claim 1 wherein a near-field probe comprises a coated optical fiber is used in measuring the analyte.

8. A method according to claim 1, wherein the analyte is a gas, a vapor, or suspended in a gas.

9. A method according to claim 1, wherein a mixture of analytes is screened, and the signal output represents the overall properties of the mixture.

10. A method according to claim 8 comprising collecting gases by a static or dynamic headspace technique.

11. A method according to claim 10, wherein at least one member of the group consisting of heat, electromagnetic radiation, electricity, magnetism, and mechanical vibration at least assists in transferring the analyte from the material to a gaseous or vaporized form.

12. A method according to claim 8 wherein the gas sensing means comprises at least one member of the group consisting of a semiconductor gas sensing device, a conductive polymer gas sensing device, a surface acoustic wave gas sensing device, a microbar sensing device, a micromechanical probe, a quartz crystal microbalance, and an optical sensor.

13. A method according to claim 8 wherein the gas sensing means comprises at least a metal oxide semiconductor gas sensing device.

14. A method for monitoring a process of preparing or assembling parts into an electronic assembly, comprising the steps of:

collecting a gaseous or vaporized species from at least one member selected from the group consisting of a circuit board, a solder paste, a solder, a solder flux, an epoxy, a conductive epoxy, a resin, an electronic component, a discrete component, a thermally conductive paste, an adsorbent, an encapsulant, a coating, a filler, a lubricant, a reactant, a byproduct, a contaminant, and a tag;

screening at least one of the gaseous or vaporized species with a screening means comprising a n number of sensing probes, where n is an integer of at least one so that more than one physical, chemical, or physico-chemical change which defines the information is detected by the probe to produce at least one signal output; and

analyzing the signal output with multivariate analysis to convert the signal output into information representative of the process and or its components.

15. A method according to claim 13, wherein a part is a circuit board or a multichip module.

16. A method according to claim 13, wherein the contaminant is at least one member of the group consisting of anions, organic acids, organics, and particulates.

17. A method according to claim 13, further comprising the step of using the information in a feedback loop to control the process.

18. A method according to claim 15, wherein the circuit board is in a soldering operation.

19. A method according to claim 15, wherein the circuit board uses surface mount technology.

20. A method for monitoring a process of packaging or encapsulating a material used in electronics or optics with a package or encapsulant, comprising the steps of:

collecting a gaseous or vaporized species from at least one member selected from the group consisting of the material, the package, and the encapsulant;

screening at least one of the gaseous or vaporized species with a screening means comprising a n number of sensing probes, where n is an integer of at least one so that more than one physical, chemical, or physico-chemical change which defines the information is detected by the probe to produce at least one signal output; and

analyzing the signal output with multivariate analysis to convert the signal output into information representative of at least one member selected from the group consisting of the process, the material, the package, and the encapsulant.

21. A method according to claim 20, wherein the material and the package are part of at least one member selected from the group consisting of an integrated circuit, a multichip module, an optoelectronic device, an integrated circuit board, a memory module, and an electronic device.

22. A method according to claim 20, wherein at least one analyte is water or residual solvent and the information represents the degree of popcorning.

23. A method according to claim 20, wherein the encapsulant is a water barrier or a moisture barrier.

24. A method for probing at least the quality of a material used in electronics or optics, the method comprising the steps of:
selecting a sample of the materials from a storage environment or a manufacturing process;
collecting a gas from the sample;
analyzing the gas with n number of sensing probes, where n is an integer of at least one so that more than one physical, chemical, or physico-chemical property detected by the probe and combined to produce a signal output;
performing a multivariate analysis on the signal output to characterize the material, the storage environment, or the manufacturing process.

25. A method according to claim 24, comprising a step of selecting a component or processing aid used in plastic molding compounds.

26. A method according to claim 24, wherein the plastic molding consist of about 45% to about 95% inorganic filler and about 5% to about 55% organic materials.

27. A method according to claim 24; wherein the inorganic filler consists of silica.

28. A method according to claim 24, wherein the organic materials comprises some resin compounds.

29. A method according to claim 24, wherein the organic materials comprises some hardener or catalyst compounds.

30. A method according to claim 24, wherein the material comprises a semiconductor.

31. A method according to claim 30, comprising a step of selecting a semiconductor materials comprising insulating dielectric materials.

32. A method according to claim 30, comprising a step of selecting a semiconductor materials comprising a modified silicon wafer.

33. A method according to claim 24, wherein the materials comprises oxides.

34. A method according to claim 24, wherein the material comprises a superconductor.

35. A method according to claim 24, wherein the material comprises a plastic.

36. A method according to claim 24, wherein the material comprises a composite.

37. A method for characterizing an electronic device, the method comprising the steps of:

screening the electronic device with n number of sensing probes, where n is an integer of at least one so that more than one physical, chemical, or physico-chemical property detected by the probe and combined to produce a signal output;

processing the signal output with multivariate analysis to convert the signal output into information representative of the device, an operating characteristic of the device, or a property of the device.

38. A method according to claim 37, further comprising analysis of electronic signals in the device and n is an integer greater than one.

39. A method according to claim 37, further comprising using the information to control the device.

40. A method according to claim 37, wherein the screening is of a gas or a vapor within the electronic device.

41. A method according to claim 37, wherein the operating characteristic is device performance, optimization, analysis, or failure prediction according to device specification.

42. A method according to claim 37, wherein the device is a data storage disk drive or a component within the data storage disk drive.

43. An apparatus for probing at least the quality of a material used in electronics or optics, comprising:

a multivariate detector having at least one of a sensing probe, sensing location, or physicochemical property,

the multivariate detector capable of detecting an analytes that is at least one member selected from the group consisting of the material, a constituent of the material, a byproduct of the material, and a reaction product of a constituent of the material, and a tag;

transmission means, capable of transmitting a signal between the multivariate detector and a data acquisition system, capable of converting the signal into raw data;

a computational device capable of processing at least part of the raw data using multivariate analysis to create a data set; and

an output device capable of displaying, storing, or using the data set.